Deployment &Traveler's Diarrhea

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Diarrhea Deaths

- **Second only to cardiovascular disease as a cause of death worldwide**
  - **Leading cause of childhood death**
  - **5-6 million children die annually in Asia, Africa and Latin America**
  - **~10,000 children die annually in the US**
  - **Averages of 7-19 cases per child per year in some areas**
- **Deaths in adult travelers with diarrhea are rare**

Traveler's Diarrhea
Prevention and Self Management

- **The risk of traveler's diarrhea for each week spent in a developing nation is 20 - 25%.**
  - **Varies from country to country, and in different areas in one country.**
  - **Rates of 40 - 60% are not uncommon with several weeks travel.**
- **Mortality has not been described.**
- **Morbidity may be significant.**
  - **Untreated cases last an average 3 - 4 days.**
  - **Affected persons average 17 unformed stools.**
  - **Cramps, nausea, vomiting, and fever may be present.**

Traveler's Diarrhea
Definitions

- **Healthy person < 150 mL (of liquid in) stool in one or more BMs per 24 h**
- **A patient with diarrhea often passes > 200 mL of liquid in stool in > 3 unformed movements in 24 h.**
- **If < 150 mL total liquid volume, generally considered "loose stools" and not diarrhea**
- **Traveler's Diarrhea is defined as ≥ 3 unformed stools passed in 24 h and at least one associated symptom of enteric dz:**
  - **nausea**
  - **vomiting**
  - **abdominal pain**
  - **fever**

Traveler's Diarrhea
Associated Risks

- Rural areas and tropical climates associated with > risk than cooler climates and urban areas.
- The major source of infection appears to be food.

  Food cultures may reveal bacterial contamination equivalent to feces.
- Water-associated diarrhea typically caused by viruses or parasites > bacteria.
  - Freezing decreases, but does not eliminate, bacteria in water.
  - Heating to boiling for one minute destroys most pathogens.
  - Boiling for five minutes is recommended to kill all pathogens.

Are you eating food or feces?

- **Fecal contamination determined by presence of *E.coli* in food from Guadalajara:**
  - **28 hot sauces from 12 restaurants**
  - **67 - 100% of the different sauces were contaminated**
  - **mean number of colony counts: 3,100 - 13,500 colonies/gram (some with 30,000)**
- ***E. coli* contamination in Mexican restaurants in Houston:**

  40% of 25 sauces contaminated with a mean of 3.6 colonies per gram.

DuPont et al Abstract 204 at 36th IDSA in *CID* Vol 27 No 4; Oct98

Common Pathogens Causing Diarrhea in Travelers to Mexico

	Organism	Percent
Bacterial	***Enterotoxigenic E. coli***	**40**
	Shigella spp.	**15**
	Salmonella spp.	**7**
	Enteroadherent E. coli	**7**
	Enteroinvasive E. coli	**< 5**
	Campylobacter jejuni	**< 5**
Viral	***Rotavirus***	**5-10**
	Norwalk virus	**5-10**
Parasitic	***Giardia lamblia***	**2**
	Entamoeba histolytica	**1**
	Cryptosporidium	**<1**
Unknown		**<5**

Ericsson and Johnson in Travel Medicine Advisor

Escherichia coli

Serologically Defined

- **O serogroup (lipopolysacharide Ag)**
- **H serogroup (flagellar Ag)**
- **K serogroup (capsular Ag)**
- **> 171 O serogroups**
- **> 70 H serogroups**

ETEC
Enterotoxigenic E. coli

1. Most common cause of Traveler's Diarrhea
2. Incubation Phase of 24 – 72 hours
3. Profuse water diarrhea, nausea, cramps, low-grade fever lasting 3 - 5 days
4. "Fecalized" food is vehicle of transmission.
5. Fecal leukocytes, blood, and mucous are not present.
6. Rx: Fluoroquinolones or TMP/SMX
7. Toxin elaborated: heat labile (LT) or stable (ST)
8. The LT toxin is molecularly similar to the cholera toxin.

EHEC

The strain that made *E. coli* a household name

- O157:H7 associated with most cases of hemolytic uremic syndrome
- Bloody diarrhea without fever or fecal leukocytes
- 1982 multi-state outbreak associated with hamburgers
- Undercooked ground meat, salami, milk, others
- Cytotoxin produced resembles Shiga toxin of *Shigella*
- Can be seen in institutional outbreaks
- Treatment with antibiotics may **increase** morbidity and mortality.

E. coli Diarrhea
Other Strains

- **EIEC - *Enteroinvasive E. coli*:**
  - **produces Shiga-like toxins**
  - **disease clinically indistinguishable from *Shigella* with severe abdominal cramping, watery diarrhea, tenesmus, and fever progressing to scanty stools with blood and mucous**
  - **incubation is as short at 10 - 18 hours.**
- **EPEC - *Enteropathogenic E. coli*:**
  - **first described category of *E. coli* diarrhea**
  - **almost exclusively in infants, especially in developing countries.**
- **EaggEC - *Enteroaggregative E. coli*:**
  - **another cause of mainly infant diarrhea**

Shigellosis

Shigella spp

- **Four species associated with human disease**
  - ***S. sonnel*, *S. boydii*, *S. flexneri*, and *S. dysenteriae***
  - **All but *S. flexneri* are toxin mediated**

- **Ingestion of 100 organisms → diarrhea**

- **Usually noninvasive but associated with a diffuse colitis**

  Penetration of the intestinal mucosal epithelium occurs but further extension does not.

- **Typically biphasic:**
  - **Begins as frequent, high-volume, watery stools like *ETEC***
  - **Gradually lower volume, bloody, mucoid stools as the colon becomes involved**

- **Fever, tenesmus, blood, and mucous are commonly seen.**

Salmonellosis

Salmonella spp

- ***Salmonella*, one species with many different serotypes**
  - **thousands of serotypes associated with gastroenteritis**
  - ***S. typhi* (typhoid fever) in fewer than 1 in 10,000 travelers, other serotypes cause nontyphoidal salmonellosis**
- **Incubation period is variable and probably related to inoculum:**
  - **may be as short as 6 hours**
  - **usually 12 - 36 hours**
  - **may be as long as 10 days.**
- **Symptoms very varied among individuals, even if the same strain.**
  - **No sx, constipated, watery diarrhea, bloody diarrhea, FUO**
  - **Often invasive and diagnosed by blood culture**
- **Bacteria shed for variable period of time, a few weeks to months or years. May be prolonged with treatment.**

Typhoid
Salmonella typhi

- < 500 cases/year in US, most from OCONUS
- estimated attack rate for travelers: 1 in 30,000
- Transmitted by fecal or urinary contamination of food or water
- Shellfish, milk products, hand carriage, filth flies often implicated sources

Typhoid
Clinical Disease

- **Incubation varies with inoculum (3 - 60 days), typically 1 - 3 weeks**
- **Systemic illness with sudden onset**
  - **sustained fever, HA, malaise, anorexia**
  - **splenomegaly, lymphadenopathy**
  - **truncal erythematous rash “rose spots” (fleeting)**
  - **nonproductive cough**
  - **constipation**
- **Case fatality rate of approximately 10%**
- **Chronic carriers may occur even after asx dz, especially associated with gallstones and *Schistosomia hematobium***

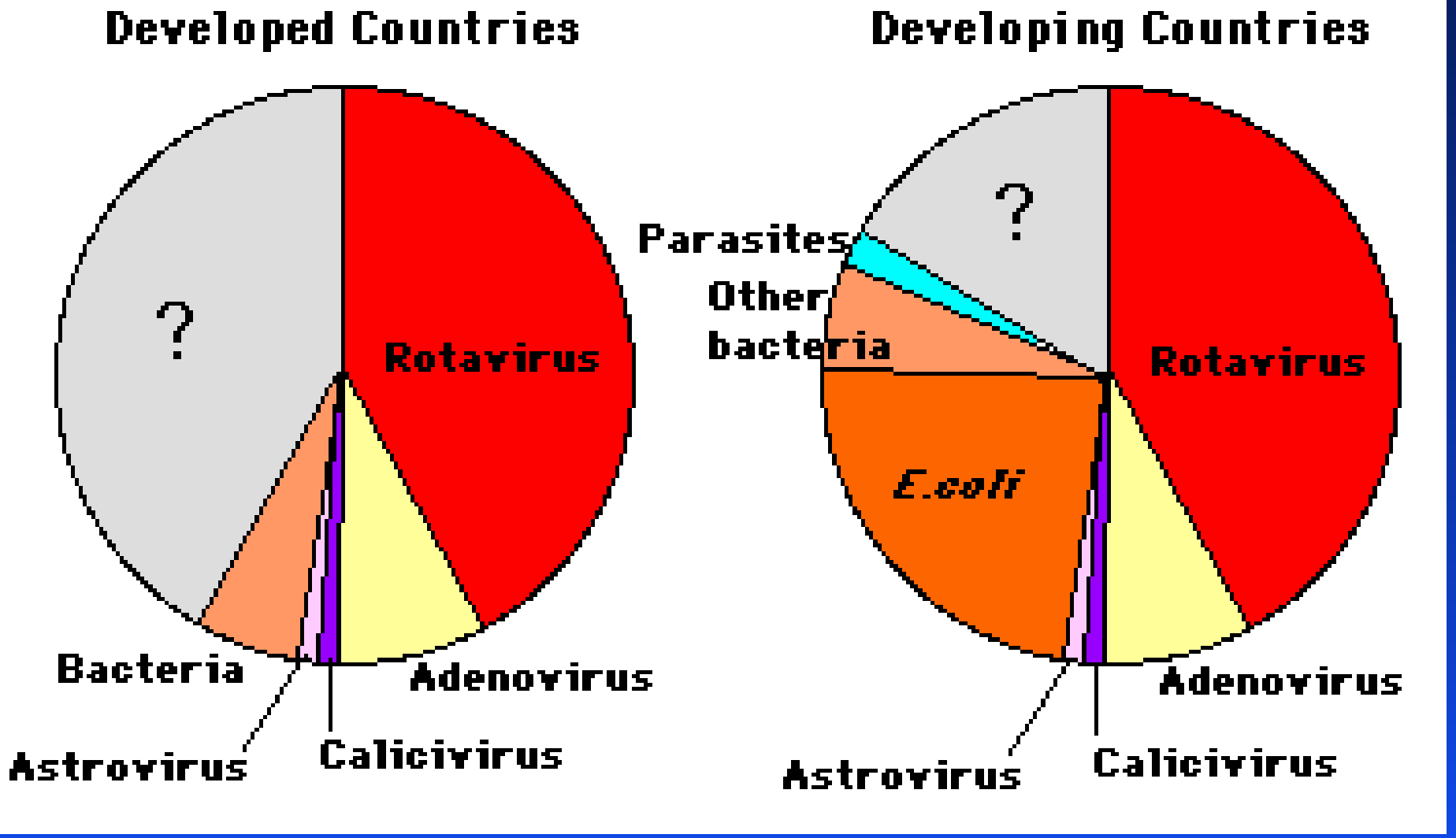
Campylobacteriosis
Campylobacter jejuni

- **Predominant cause of Traveler's Diarrhea n SE Asia > *ETEC***
  - **in North Africa and Mexico more common in winter/dry season**
- **Poultry, dairy products, or unchlorinated water. Exposure to a variety of live animals may also be a source.**
- **Incubation period 3 - 5 days, range 1 - 10 days**
- **2 - 5 day illness, typically over in 10 days, occasionally prolonged, lasting for weeks**
- **Fever, abdominal pain, nausea, vomiting, diarrhea (often bloody) are symptoms**
- **Untreated typically shed organisms for 2 - 7 weeks**

Cholera
Vibrio cholerae

- **Most cases - asymptomatic infections (~ 95%)**
- **Diarrhea - 500 to 1,000 ml/hr**
- **Fever - low-grade, if present (25%)**
- **Vomiting**
- **Tachycardia**
- **Hypotension**
- **Vascular collapse**
- **Dry tongue, oliguria, decreased skin turgor, sunken eyes, wrinkled fingers, raspy voice, acidosis, and Kussmaul breathing**

Not all travel diarrhea is bacterial



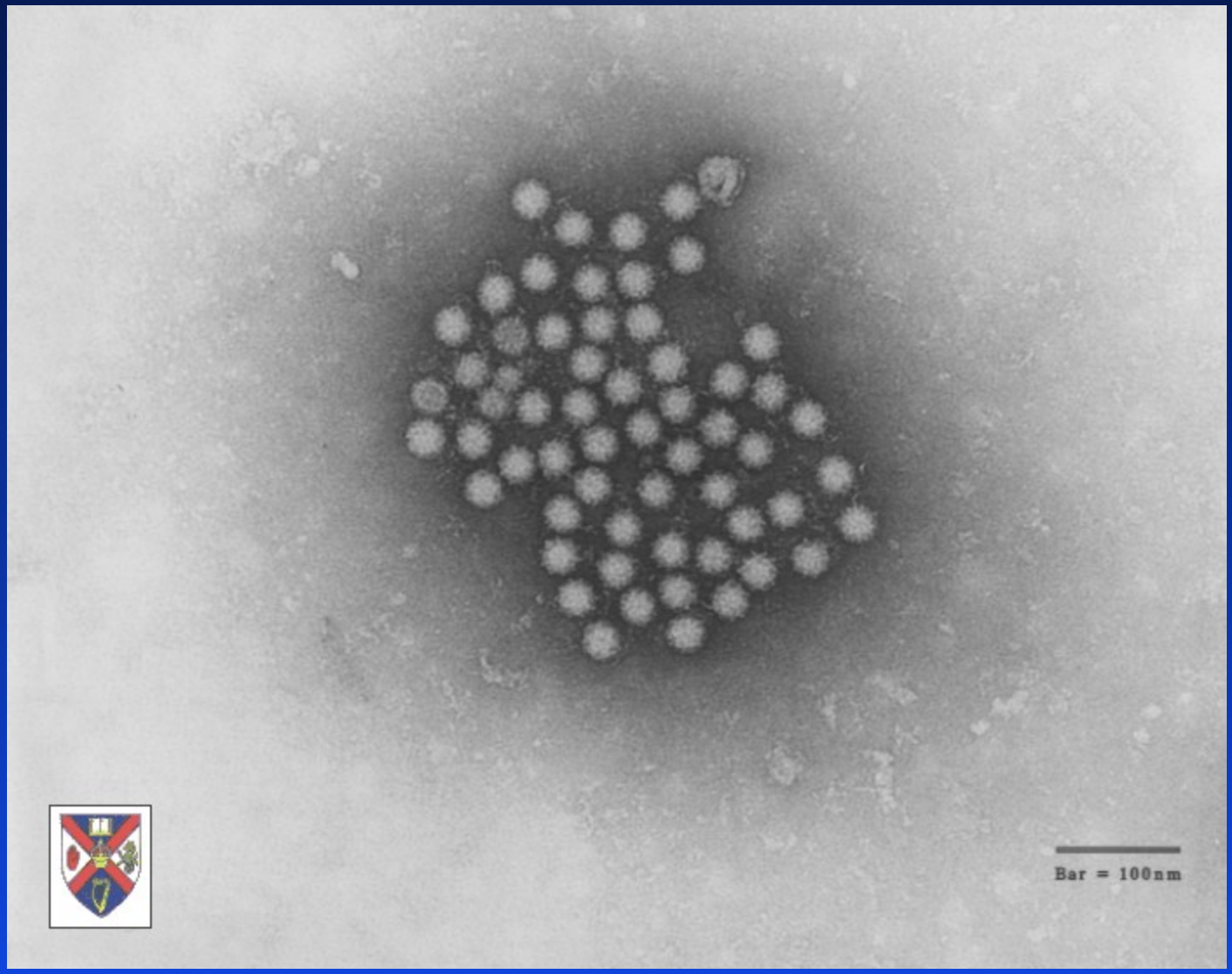
Etiology of Diarrhea in Children < 24 months old

Norwalk Virus: Desert Storm

A Study of 883 USMC & Navy, Dec 90 - May 91

Symptoms	Norwalk ELISA
vomiting only	23.5%
vomiting & diarrhea	12%
diarrhea only	6.5%
neither	3%

JID 1993;167:986-7. Note: 61% had GI sx, 9.4% had 4-fold rise of ELISA sero



Caliciviruses

Cruise Ship Associated Diarrhea

- Norwalk-like Viruses
- Frequently spread via fomites
- Hand washing is most important
- Increased numbers of children on cruise ships probably plays a role

“Noro” Virus Diarrhea

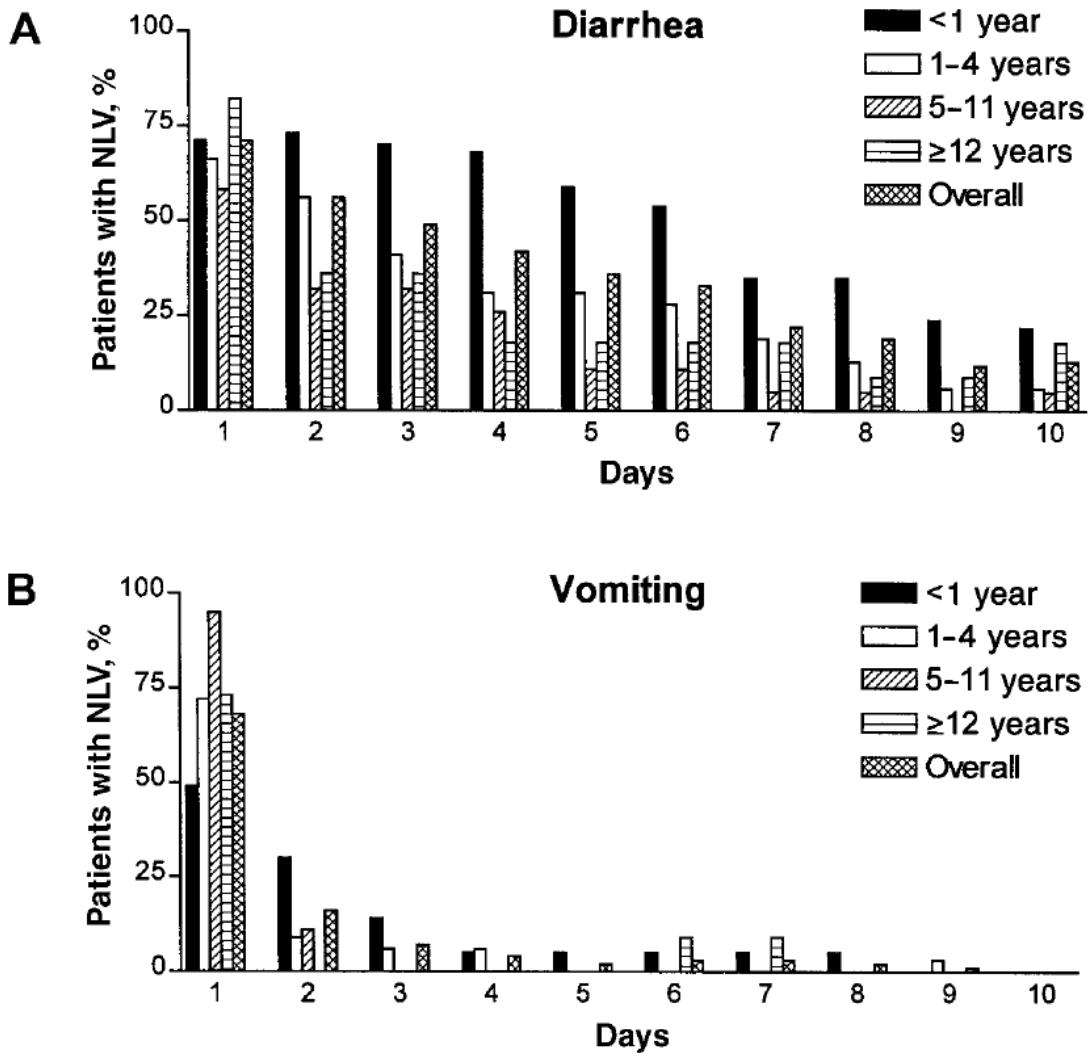


Figure 2. Proportion of Norwalk-like virus (NLV) cases associated with diarrhea *(A)* or vomiting *(B)* in patients aged <1, 1–4, 5–11, and ⩾12 years

Rockx et al CID 2002; 35:246–53

Food “Poisoning”

Staph aureus

- Pre-formed heat-stable toxin

- Dx: vomiting and diarrhea 1 - 4 hours after ingestion

Clostridium perfringens

- Nausea, no vomiting, abdominal cramps, and watery diarrhea 8 - 16 hours after ingestion

Bacillus cereus

- Mimics staph, and can also mimic *C. perfingens*

- Associated with ingestion of re-cooked rice

Drug-Resistant Traveler's Diarrhea?

615 Bacterial Isolates in US Students with TD Summering in Guadalajara

	1988	1997
Ampicillin	38%	58%
Doxycycline	31%	69%
Furazolidone	21%	69%
Trimethoprim	3.4%	71%
Fluoroquinolones	3.4%	71%

DuPont et al Abstract 204 at 36th IDSA in *CID* Vol 27 No 4; Oct 98

Traveler's Diarrhea
Empiric Treatment in Adults

Severity	Antibiotic	Antimotility Agent
Mild (1 – 2 loose stools without fever or blood)	Not indicated	Observe or loperamide 2 mg after each loose stool or bismuth subsalicylate 2 qid
Moderate (<3 BMs without fever or blood)	Consider quinolones, single dose or standard dose x 3 days	Loperamide or bismuth
Moderate to Severe (>3 BMs with fever and/or cramping)	Quinolones, eg levofloxacin 400 mg po qd, consider single dose	Loperamide or bismuth
Severe (>6 BMs with fever and/or heme, tenesmus)	Quinolones for five full days	Avoid unless close observation

Quinolones are generally considered best. Levoflox lower MICs than ciproflox
In some areas, esp SE Asia,> 80% of *Campylobacter* is quinolone resistant but responds to azithromycin 500mg po qd x3.

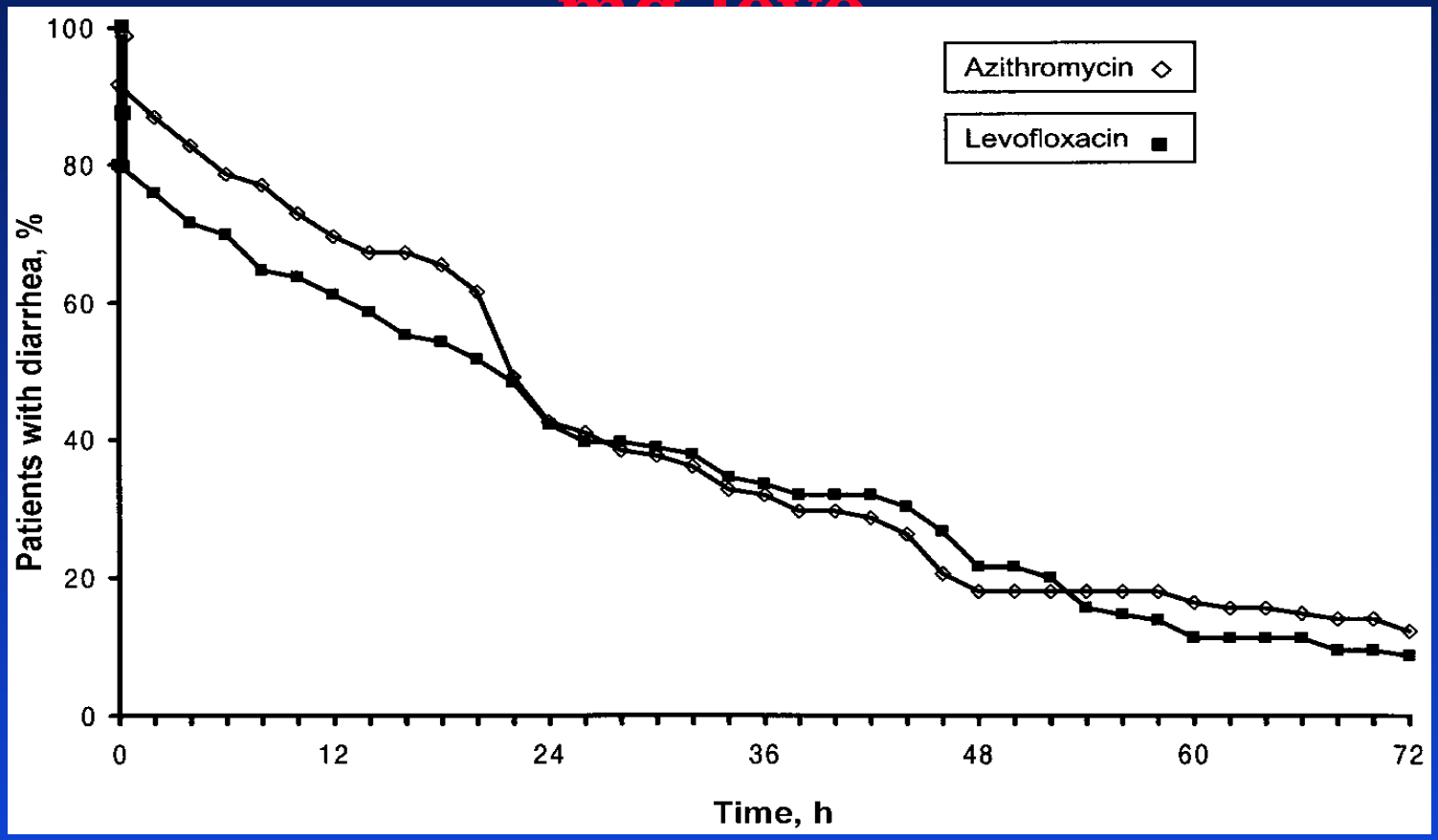
Traveler's Diarrhea in Children

Empiric Treatment in Children

- **Controversial due to increased risk of HUS in *EHEC* cases treated with antibiotics**
- **TMP/SMX is generally recommended, but high levels of resistance in the tropics**
- **If child did not respond to TMP/SMX, consider using cefixime or azithromycin.**
- **Quinolones are not approved in < 16 yo, but contraindications are mainly from animal studies.**

Azithromycin for Diarrhea?

Single dose 1000 mg azithro vs 500 mg levo



Azithromycin (105 subjects) vs. levofloxacin (106 subjects) for treatment of travelers' diarrhea (percentage remaining with diarrhea after initiation of therapy). Study performed in Guadalajara, Mexico

Adachi et al. Clin Infect Dis 2003; 37:1165-71

Azithromycin vs Levofloxacin

Table 2. Microbiologic outcome after treatment with azithromycin or levofloxacin in US students who acquired travelers' diarrhea in Guadalajara, Mexico.

	Azithromycin group (n = 105)		Levofloxacin group (n = 106)	
Pathogen	No. of subjects with pathogen identified	Microbiologic cure, % of subjects	No. of subjects with pathogen identified	Microbiologic cure, % of subjects
ETEC alone	55	55	57	61
Shigella species	1	100	3	100
Salmonella species	1	100	2	100
Shigella species and ETEC	5	80	8	100
Salmonella species and ETEC	0	0	1	100
Any bacterial pathogen	62	58	71	69

NOTE. Denominators used to calculate percentages of subjects with microbiologic cure may differ from overall no. of subjects in whom pathogens were identified, because posttreatment samples were not always available. ETEC, enterotoxigenic *Escherichia coli*.

Adachi et al. Clin Infect Dis 2003; 37:1165-

Pre Travel Antibiotics for Diarrhea

Is there a role for true prophylaxis?

- Controversial
- Extremely high risk with short term, mission essential orders could consider:
  - Quinolones
  - Azithromycin
  - Bismuth
- Risk of side effects may be substantial
- Gives false sense of assurance that may allow for riskier behavior
- Still does not prevent viral, protozoal or helminthic infections

Work up for Diarrhea

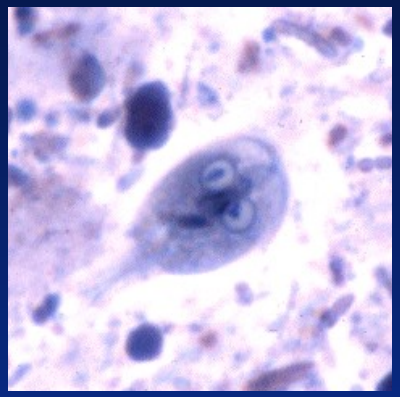
- **Depends on the setting**
  - **Deployed with access to some lab:**
    - **Worthwhile to get stool cx and sens for initial cases to help define what pathogens are present and which therapy to use**
  - **Deployed with no lab but massive outbreak:**
    - **Collect stool in 3-5 cases and attempt to get sent to local lab or back to CONUS for w/u**
  - **In CONUS with lab capability:**
    - **Typically viral, may not need antibx at all, if sporadic and mild dz, would not w/u**
    - **If large outbreak, worthwhile to check stools to determine etiology for future cases**

Post-Travel Diarrhea
Chronic

- **Diarrhea continuing for two weeks or longer usually presents after return from travel.**

- **Consider possible protozoal etiologies as more likely in this group:**
  - ***Giardia lamblia* is the most common.**
  - ***Entamoeba histolytica***
  - ***Cryptosporidium parvum***
  - ***Isospora belli***
  - ***Cyclospora cayetanensis***

- **Need fresh stool examined with conventional and modified acid fast staining.**
  - **May need repeated exams (three pick up > 90%).**
  - **May end up treating presumptively.**



Giardiasis

- **The most prevalent enteric parasite in the US and Canada**
  - **~4% of 300,000 stool specimens**
- **In the developing world one of the 1st infections in infants**
  - **Peak prevalence rates 15-20% in children <10 yo.**
- **Generally water borne and probably carried by many animals**
- **Consider in all patients with prolonged diarrhea, especially if associated with malabsorption or weight loss.**
- **Dx with a stool EIA (more sens. than microscopy, esp. if inexperienced)**
- **Treat with metronidazole 250mg tid x 5 days**
  - **Albendazole is alternative for metronidazole tolerant strains**
  - **Furazolidone 100 mg qid x 7d (available as suspension but $$$)**
  - **Tinidazole (not yet in US) will tx effectively with a single 2.0 g dose**

Amebiasis
Entamoeba histolytica

- ***E. histolytica* - very prevalent in Mexico, India, Africa, Central and S. America**
  - **morphologically indistinguishable but commensal, *E. dispar* causes far more infxns but is not associated with symptoms**

- **Routes of transmission:**
  - **Contaminated food and water**
  - **Direct fecal-oral contamination**

- **Symptomatic dz in 80-98% and invasive dz in 2-20%:**
  1. **Dysentery with small vol, bloody stools and fecal leuks**
  2. **Colitis with ulcerations of the mucosa and flask-shaped abscesses**
  3. **Formation of a fibrotic mass in the intestinal wall – ameboma**
  4. **Hematogenous spread of trophs to R lobe of the liver, brain, pericardium and lung**
  - **Chronic amoebic colitis is indistinguishable from inflammatory bowel dz**
    - **Use of steroids in these patients may lead to toxic megacolon and perforations**

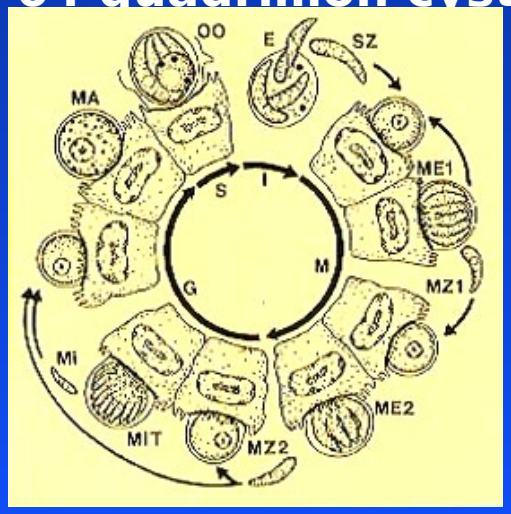
Okhuysen CID 2001;33:110-4

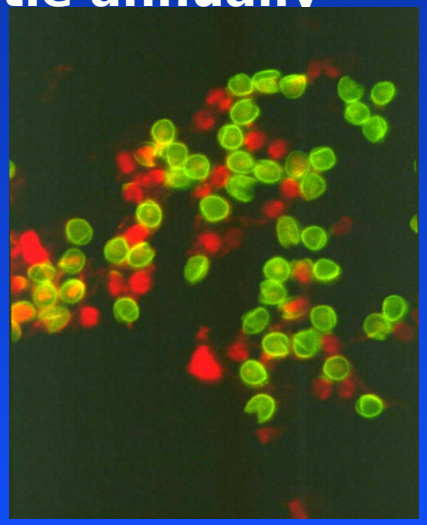
Amebiasis
Entamoeba histolytica

- **Diagnosis**
  - **Fresh stool examination with Trichrome stain or PAS stain of colon bx**
  - **Fecal Ag studies using ELISA are needed to distinguish from *E. dispar***
- **Treatment**
  - **Metronidazole 750 tid x 10 d**
  - **Tinidazole, not yet approved in the US, 1.0 g bid x 3 d**
  - **Above work in tissue but are not luminal agents and must be followed by paromomycin 500 mg po tid x 7 d.**

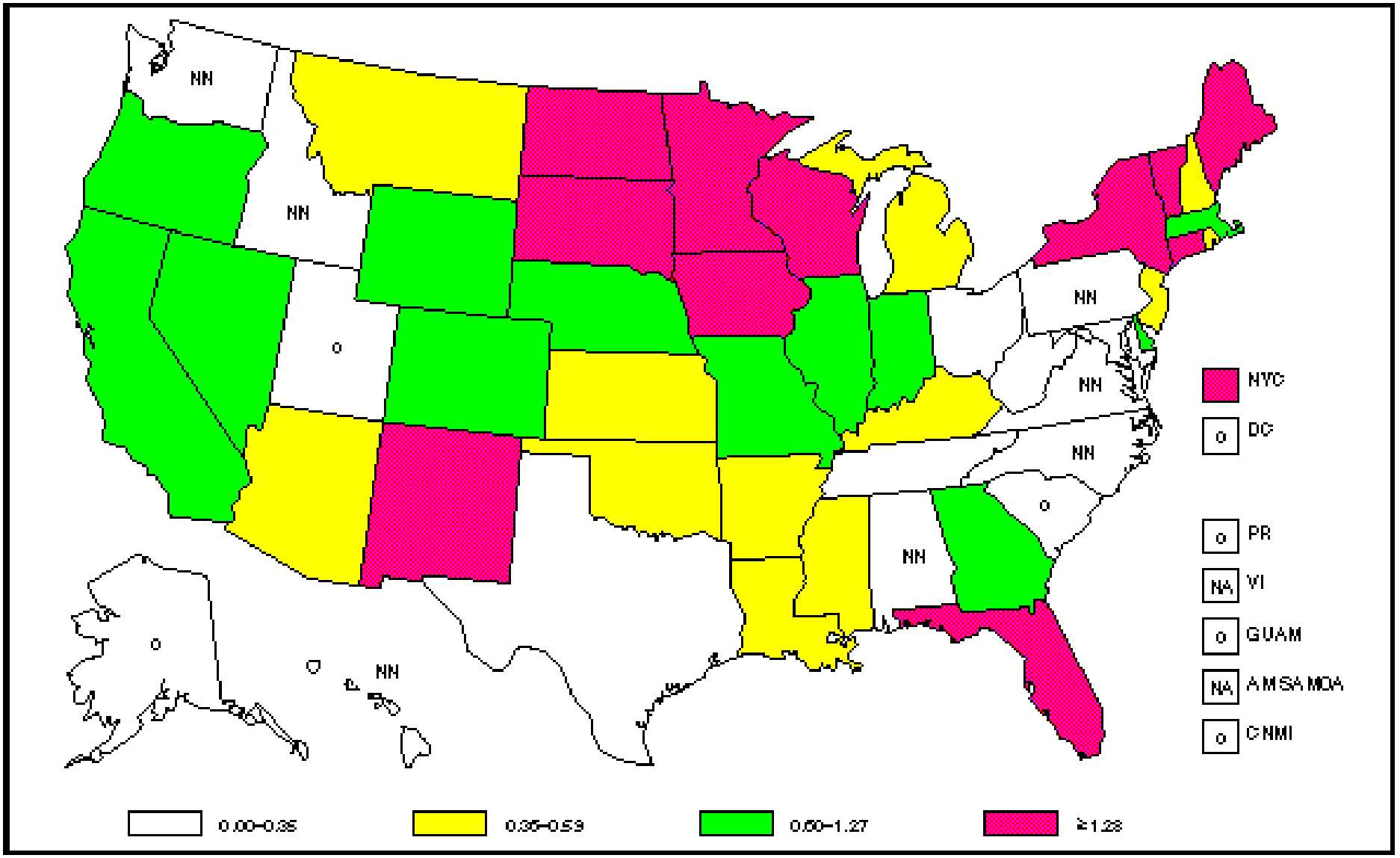
Cryptosporidiosis
Cryptosporidium hominis and *C. parvum*

- Protozoan pathogen of the small bowel increasingly recognized worldwide.
- 30-50% of US population with Ab
- 60-85% of developing countries pop. have Ab
- Often associated with water contaminated by cattle feces
  - Primarily infects neonatal animals
  - ~64 quadrillion cysts from US cattle annually



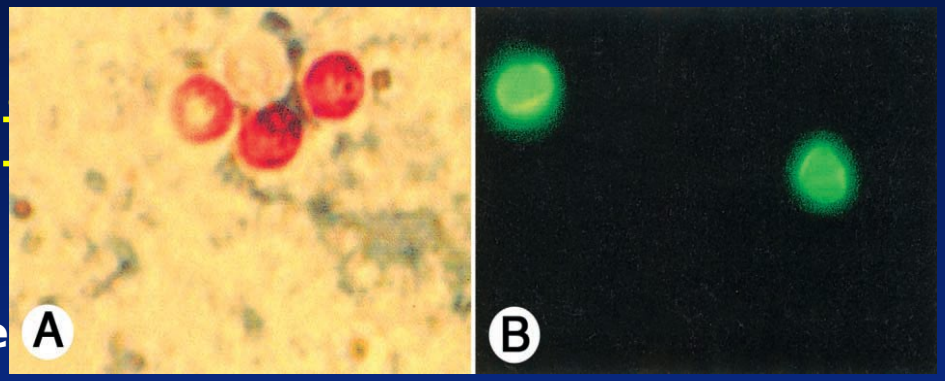


CRYPTOSPORIDIOSIS — reported cases per 100,000 population, United States and territories, 1997



Surveillance data from 1997 suggest that infection with cryptosporidium is geographically widespread. The highest reported rates were primarily in the north central and northeastern states. As in 1995 and 1996, cases primarily were reported in the late summer among children and adolescents aged <16 years.

Cryptosporidiosis



- Rapid incubation, ~3 days post inge
- Highly infectious with as few as 10 cysts ingested
- Resistant to chlorine
- Self limited dz in immunocomptent, usually 5-7 days
  - Profuse watery diarrhea
  - Fatigue, malaise
  - Low grade fever
  - Nausea and vomiting in <20%
- Neonates, elderly and immunocompromised may have chronic diarrhea
- Diagnosis with modified acid fast stain or, more commonly stool EIA
- No therapy indicated (or very effective) in immunocompetent
  - In immunosuppressed with chronic diarrhea may try combination of azithromycin and paromomycin

Leav et al. Clin Infect Dis 2003; 36:903–8

Chronic Diarrhea
Helminths

- **Uncommon in most short term travelers**
  - **more common in those who return after months to years in the developing world**
- ***Ascaris, Strongyloides*, *Trichuris, Necator* and *Ancyclostoma* (hookworm) are the most common**
- **Light infections are typically asx after pulmonary phase has passed**
- **Heavy infestations are more likely to be symptomatic and are easier to dx.**
- **If scant number of eggs/larva then think about other undx orgs**
  - **ie. *Giardia, Entamoeba, Cryptosporidium***

Diarrhea in Travelers or Deployed

Work Up

Initial W/U

- Fresh stool sample
  - Not refrigerated overnight
- Fecal leukocytes
- Fecal occult blood
- Fecal lactoferrin

After initial W/U

- Culture and sensitivity
- EIA for Giardia and Cryptosporidium
- Stool microscopy for O&P (up to 3x)
  - If not examined fresh then fix immediately
  - Trichrome
  - Modified AFB

Water Disinfection for International and Wilderness Travelers

- **Heat is still the best way to inactivate all organisms in water**
- **Time consumin**
- **Fuel needed**
- **May disclose location if operational**

Organism	Lethal temperature and time
Giardia species	55°C[a] for 5 min 50°C for 10 min (95% inactivation) 60°C for 10 min (98% inactivation) 70°C for 10 min (100% inactivation)
Cryptosporidium species	64°C within 2 min 72°C heated up over 1 min
E. coli, and *Salmonella, Shigella,* and *Campylobacter* species	65°C[b] for 3 min
Vibrio cholerae	60°C for 10 min 100°C for 10 s
E. coli	60°C for 5 min 70°C for 1 min
Enteric viruses	56°C–60°C for 20–40 min <1 min at ⩾70°C[c]
Hepatitis A virus	98°C for 1 min 85°C for 1 min

Backer. CID; 2002; 34:355-64

Table 3. Susceptibility of microorganisms to filtration, by size.

Organism	Approximate size, μm	Maximum recommended filter rating, μm
Virus	0.03	NA[a]
Escherichia coli	0.5 × 3–8	0.2–0.4
Campylobacter species	0.2–0.4 × 1.5–3.5	0.2–0.4
Vibrio cholerae	0.5 × 1.5–3.0	0.2–0.4
Cryptosporidium oocyst	2–6	1
Giardia cyst	6–10 × 8–15	3–5
Entamoeba histolytica cyst	5–30	3–5
Nematode egg	30–40 × 50–80	20
Schistosome cercariae	50 × 100	Coffee filter or fine cloth
Dracunculus larvae	20 × 500	Coffee filter or fine cloth

[a] Not applicable to most portable filters; only reverse-osmosis membranes exclude viruses by virtue of pore size.

Table 4. Recommended contact time for specified halogen concentration, according to water temperature.

Halogen concentration	Contact time, min		
	At 5°C	At 15°C	At 25°C
2 ppm	240	180	60
4 ppm	180	60	45
8 ppm	60	30	15

NOTE. Contact times are extended from the usual recommendations to account for (1) uncertainty about the presence of residual halogen and (2) the time required to kill *Giardia* cysts in very cold water.

Halogen type, organism	Concentration, mg/L[a]	Time, min	Temperature, °C	Disinfection constant, Ct
Chlorine				
Escherichia coli	0.1	0.16	5	0.016
Campylobacter species	0.3	0.5	25	0.15
20 enteric viruses	0.5	60	2	30
Hepatitis A virus	0.5	5	5	2.5[b]
Entamoeba histolytica cysts	3.5	10	25	35
Giardia cyst	2.5	60	5	150
Cryptosporidium oocyst	10	720	20	1440
Schistosome cercariae	1.0	30	28	30
Iodine				
E. coli	1.3	1	2–5	1.3
E. histolytica cyst	3.5	10	25	35
	6.0	5	25	30
Poliovirus 1	1.25	39	25	49
Coxsackie virus	0.5	30	5	15
Giardia cyst	4	15	30	60[c]
	4	120	5	480[c]

NOTE. Most experiments use a 2–3-log (99%–99.9%) reduction as the end point.

[a] Residual concentration of active chlorine disinfectant compounds.

[b] End point of 4-log reduction.

[c] A 100% rate of killing organisms; viability tested only at 15, 30, 45, 60, and 120 min.

Table 6. Dose of halogen for field-water disinfection.

Method of disinfection	Amount of halogen administered (no. of drops[a])			
	For 4 ppm	For 5 ppm	For 8 ppm	For 10 ppm
Iodination added to 1 L or qt of water				
Iodine tablets (tetraglycine hydroperiodide; e.g., EDWGT, Potable Aqua, and Globaline)[b]	1/2 tablet	—	1 tablet	—
2% Iodine solution (tincture)	0.2 mL (5)	—	0.4 mL (10)	—
10% Povidone-iodine solution	0.35 mL (8)	—	0.70 mL (16)	—
Saturated solution (iodine crystals in water; e.g., Polar Pure[c])	13 mL	—	26 mL	—
Chlorination added to 1 L or 1 qt of water				
Household bleach 5%; sodium hypochlorite	—	0.1 mL (2)	—	0.2 mL (4)
Chlorine tablets (sodium dichloroisocyanurate [e.g., AquaClear[d]])	—	—	—	1 tablet
Chlorine plus flocculating agent (e.g., AquaCure, AquaPure, or Chlor-Floc[e])	—	—	1 tablet	—

NOTE. EDWGT, emergency drinking water germicidal tablet.

[a] Measured with a dropper (1 drop = 0.05 mL) or a small syringe.
[b] Manufactured by Coghlan's Ltd., Wisconsin Pharmacal, and Van Ben Industries, respectively.
[c] Manufactured by Polar Equipment.
[d] Manufactured by Gal Pharmaceuticals.
[e] Manufactured by Safesport, World Resources, and Control Chemical, respectively.

Table 8. Choice of filtration method for types of water from various sources.

Primary concern and filtration method used	"Pristine" water in the wilderness	Tap water in developing country	Water in a developed or developing country	
			Clear surface[a]	Cloudy
Primary concern				
Giardia species, enteric bacteria	X	—	—	—
Bacteria, *Giardia* species, small numbers of viruses	—	X	—	—
All enteric pathogens, including *Cryptosporidium* species	—	—	X	—
Unpleasant taste plus microorganisms	—	—	—	X
Method used				
Heat	X	X	X	—
Filtration[b]	X	X	—	—
Halogen	X	X	—	—
Coagulation-flocculation followed by a second step (heat, filtration, or halogen)	—	—	—	X
Filtration plus halogen[c] (done in either order)	—	—	X	—

[a] Found near areas of human and animal habitation; includes agricultural runoff (from cattle grazing) or sewage treatment effluent (from upstream villages or towns).

[b] Filtration alone is adequate for eliminating *Cryptosporidium* species introduced by cattle grazing in high-quality wilderness.

[c] May include iodine resin filters (for considerations, see the "Iodine resins" subsection of the "Halogens" section of the text).

Diarrhea Prevention
Closing Points

- **Education prior to travel**
  - **food, water, hygiene issues for patients**
  - **knowledge of diarrhea epidemiology for the health provider**
- **Treatment**
  - **Proper antibiotic for primary pathogens**
  - **Antimotility agents in conjunction**
- **Work up of cases**
  - **Handling of specimens**

Case 1

- **You are the medical officer with a MEU deployed to Operation Cobra Gold in Thailand**
- **It is ~day 12 in country and you have had only 1-2 daily cases of mild diarrhea thru sick call for the first 10 days**
- **You noticed that this has increased to 6-8 per day for the last two days and some of the patients are returning with continued sx.**
- **Today the Corpsman gets you while you're eating breakfast to tell you that there are at least 20 Marines in the sick call line with diarrhea**

- **As you wade through the morning sick call you find the following:**
  - **Most patients c/o crampy abdominal pain associated with nausea and loose stools**
  - **2/21 had fever, the remainder were afebrile**
  - **The two febrile patients also had heme positive (but not grossly bloody) stool**

- **What pathogens should you be considering?**

- **Considering the prevalence of quinolone resistant *Campylobacter* sp. before you deployed, you have a large supply of azithromycin, all in the form of “Z-Paks”**
- **How do you instruct the Marines to take the azithromycin?**

- **It is two days later, yesterday and today you have also had ~20-25 Marines with diarrhea, including some of those who are returning and have received therapy for two days**

- **What should you consider?**

- **What potential diarrheal pathogens have resistance to azithromycin?**

- **Viruses**
  - **Norwalk and Norwalk like caliciviruses**
  - **Rotavirus**
  - **Adenovirus**
  - **Numerous others**
- **Macrolide resistant strains of bacteria**
- **Protozoal pathogens**
  - ***Giardia***
  - ***Cryptosporidia***
  - ***Entamoeba***

- **You decide to investigate possible sources of infection, where should you look?**

- **Food**
  - **All from approved US sources or is some local?**
  - **Are there opportunities for Marines to eat local food?**
  - **Hand washing before meals**
- **Water**
  - **Same questions as above**
- **Fomites**
  - **Diaper changing?**
  - **Hand washing after using latrines**

Case 2

- You are a flight surgeon at Incirlik AFB in Turkey, the clinic has full microscopy and culture capabilities
- Sick call has ~ 3-5 cases of acute diarrhea daily, the standard therapy is levofloxacin 500 mg qd x 3 d
- You are seeing a 26 yo Sgt who is on her third day of antibx and continues to have fever and blood tinged stools

- **She has not had stool studies performed previously, you send off fecal leuks and culture.**
- **What do you do while awaiting results?**

- She is somewhat dehydrated and you decide to give her two liters of fluid while awaiting labs.
- Sheets of fecal leuks are seen and there are many RBCs
- Should you change her antibx?
  - If so, to what?

Case 3

- **You are evaluating a 34 yo ♂ Major who returned 2 months ago from a 3- week trip to Brazil.**
- **He has complained of diarrhea for nearly 5 weeks**
- **What do you want to ask him about his illness?**

- **He has watery, blood tinged stools, 3-4x per day and has lost ~10-15 lbs.**
- **His appetite is diminished and he has frequent nausea and vague abdominal pain.**
- **He has completed two 5 day courses of levofloxacin, each time feeling slightly improved while on antibiotics**

- **What do you order to evaluate his sx?**

- **There are no fecal leuks but there are numerous RBCs**
- **His WBC is 13.2 with 78S 4B 16L 2E**
- **He has now been checking his temperature and has fever 2-3x/daily to as high as 102.3°F**
- **How does the above change your differential?**

- **Ova and parasites x3 are negative**
- **Amoebic serology is strongly positive**
- **Any other labs you should consider?**

Case 4

- **MWR has arranged for a 3 day cruise on a Carnival ship from Miami.**
- **Numerous families with children from your command have decided to take the cruise**
- **The ship has just returned from a Caribbean cruise and there is widespread media attention to the >75 cases of diarrhea that occurred.**
- **Your CO calls and wants to know if she should have MWR cancel the trip**

- **What is the most likely etiologic agent(s) of the diarrhea on the ship?**

- **What is the most likely etiologic agent(s) of the diarrhea on the ship?**
  - **Norwalk-like viruses i.e. caliciviruses; “winter vomiting illness”**
- **The tour company tells MWR that if the group cancels they will lose 75% of the cost of the trip**

- **The CO decides the group should be permitted to go. She wants you to have a “town meeting” where you explain her decision.**

- **What recs do you make?**

You actually did get this from the doorknob

- Fomites, fomites, fomites
- Water and food can be implicated
  - Especially buffets where people contaminate the food that was initially clean
- Frequent handwashing, especially before meals
- Children may be an important amplifying factor

Case 5

- You are seeing a 32 yo ACDU Tech Sgt who complains of occasional mild, crampy abdominal pain and watery stools for ~3-4 weeks.
  - BMs are ~3-5 per day and have not been associated with blood or mucous
  - She has lost ~8lbs from her baseline 132lbs
  - She is most annoyed by waking up once or twice per night to have a BM
- What questions do you want to ask her?

- **She is stationed at Travis AFB (where you are seeing her now), she has not traveled outside the US with the exception of 4 days in Mexico ~5 years ago.**

- **She did spend a month with her family at their lake house in Kentucky before arriving at Travis ~ 4 weeks ago**

- **What do you recommend?**

a. Counsel her that she is likely experiencing IBS due to stress with a new job at a new duty station

b. Recommend loperamide prn and tell her to come back if sx persist for 2 more weeks

c. Check stool culture and fecal leuks

d. Check stool for O&P

e. Recommend upper and lower endoscopy with biopsies

- **Stool cultures are negative**
- **Military health center calls to tell you that on her reenlistment PE her WBC was 9.9 with 22% eos**
- **What are you thinking of now?**

- **Stool cultures are negative**
- **Military health center calls to tell you that on her reenlistment PE her WBC was 9.9 with 22% eos**
- **What are you thinking of now?**
  - ***Giardia lamblia***
  - ***Entamoeba histolytica (*amebiasis*)***
  - ***Cryptosporidium parvum***
  - ***Necator americanus* (hookworm)**
  - ***Strongyloides stercoralis***
  - ***Enterobius vermicularis* (pinworm)**
- **Can you get these things in the US?!**

Hookworm egg in stool

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